

Supplementary Tables

Table S1. List of climatological fields used in ERA5-Land

Field	Data	reference
Land sea mask	Global Land Cover service (GLOBCOVER 2006)	Arino et al. (2007)
Orography	Shuttle Radar Topography Mission (SRTM 30)	Farr et al. (2007)
Land Use/Land Use	Global Land Cover Characteristics (GLCCv1.2)	Loveland et al. (2000)
Leaf Area Index	Moderate Resolution Imaging Spectroradiometer (MODIS collection 5)	Myneni et al. (1992)
Albedo	Moderate Resolution Imaging Spectroradiometer (MODIS)	Schaaf et al. (2002)
Soil Type	Digital Soil Map of the World (DSMW)	FAO (2003)
Lake depth	global lake database (GLDB)	Kourzeneva (2010), Balsamo et al. (2012)

Supplementary Figures

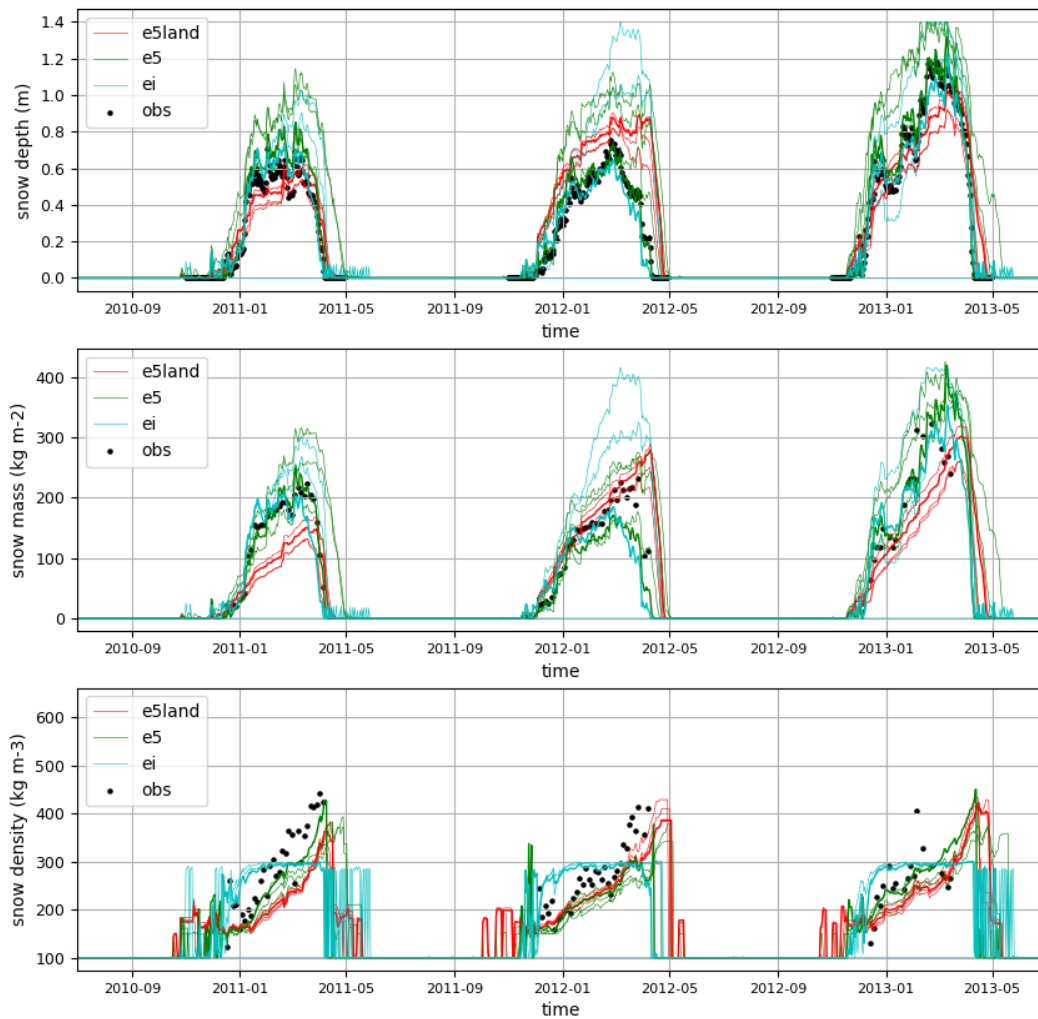


Figure S1. Time series of snow depth (top panel), mass (middle panel) and density (bottom panel) for ERA5-Land (e5land, red lines), ERA5 (e5, green lines) and ERA-Interim (ei, cyan lines) at the Sapporo ESM-SnowMIP site (see Table 3), for the period Sept 2010 to May 2013. The thicker line corresponds to the nearest point to the observations location, the thinner lines are the 3 other nearest neighbour locations.

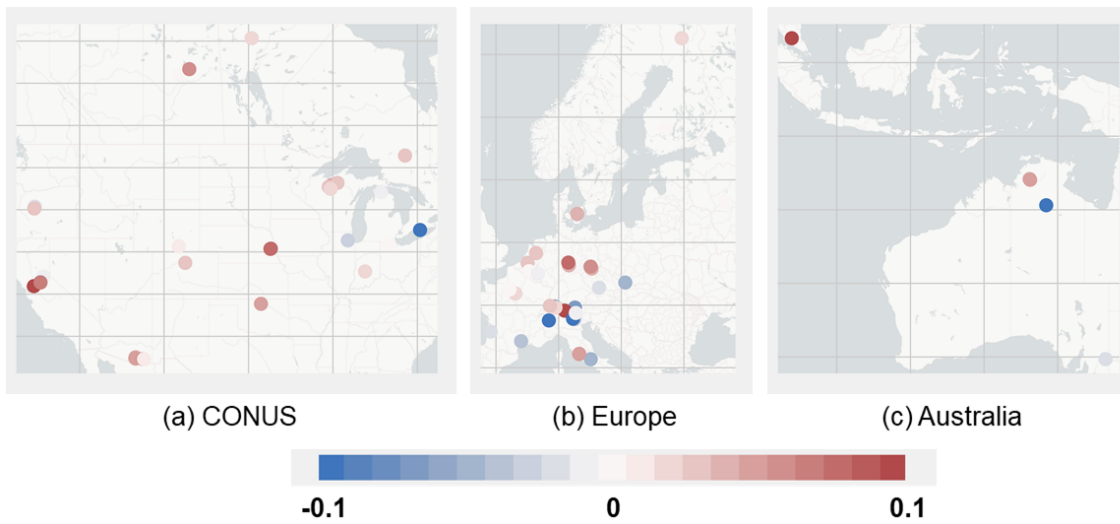


Figure S2. Standardised anomaly correlation (R_{AN}) difference of the surface sensible heat flux between ERA5-Land and ERA5 with respect to eddy-covariance data. Blue colours indicate that the anomaly correlation of ERA5-Land with respect to eddy-covariance measurements is higher than for ERA5, whereas red colours indicate the opposite.

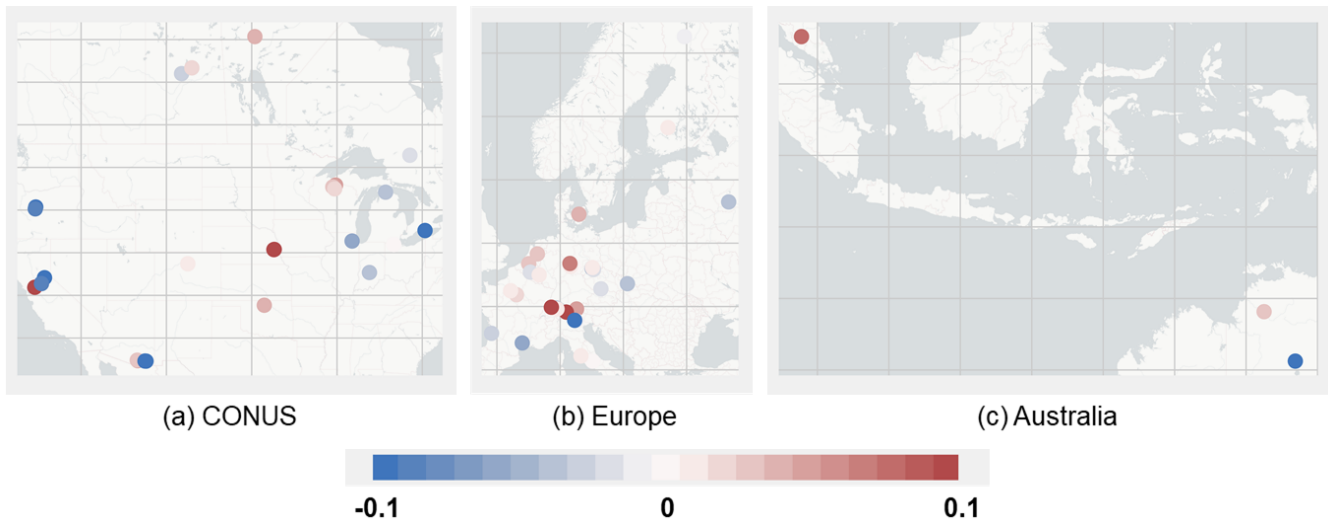


Figure S3. Standardised anomaly correlation (R_{AN}) difference of the Bowen ration between ERA5-Land and ERA5 with respect to eddy-covariance data. Blue colours indicate that the anomaly correlation of ERA5-Land with respect to eddy-covariance measurements is higher than for ERA5, whereas red colours indicate the opposite.

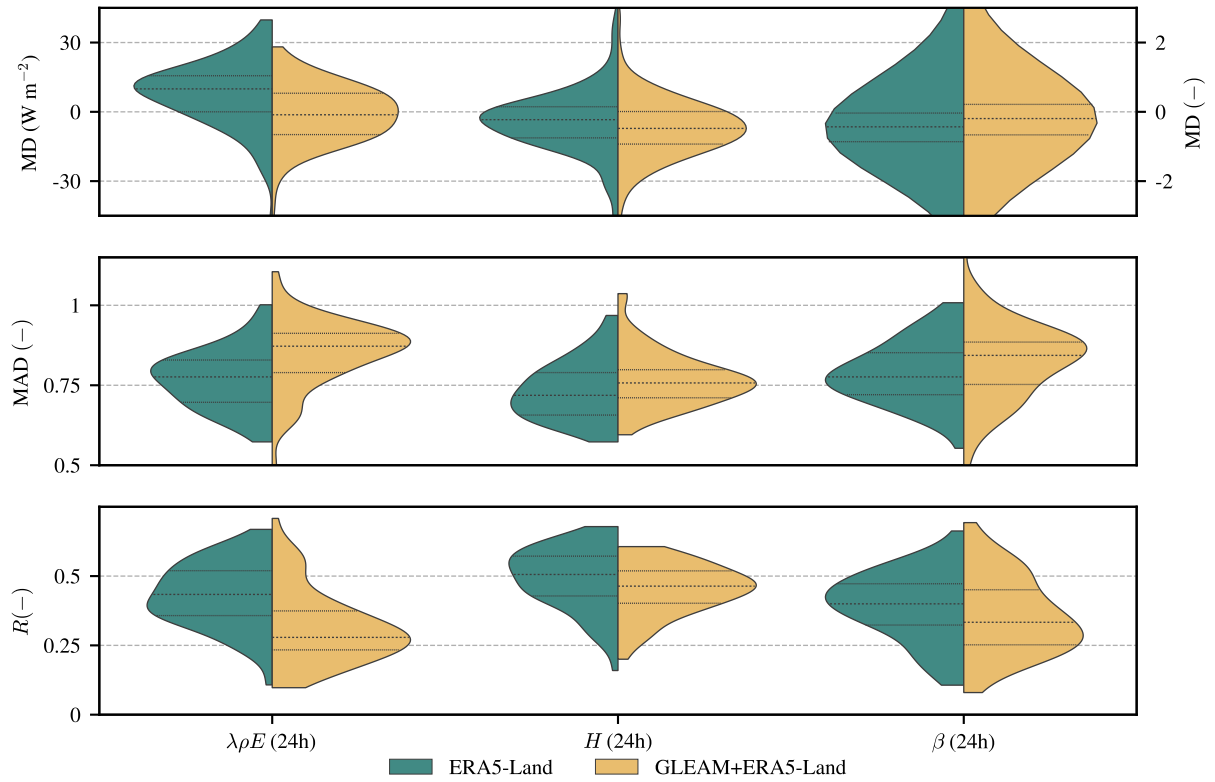
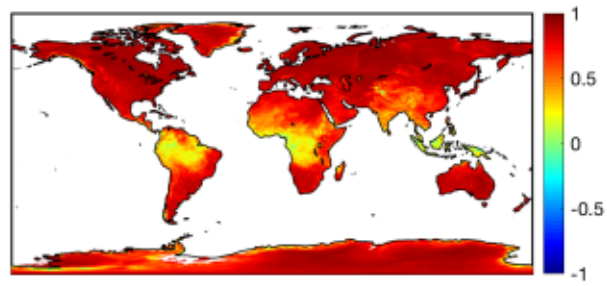
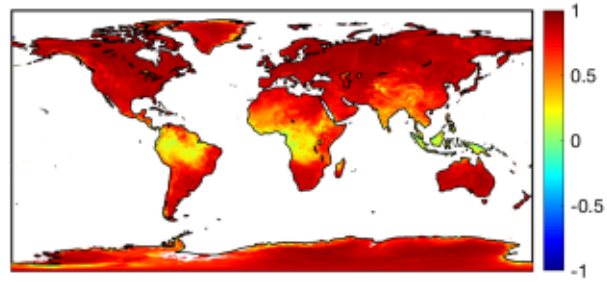


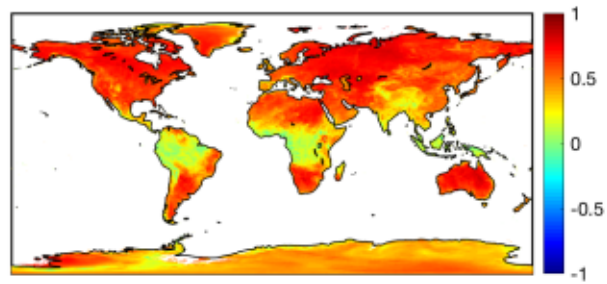
Figure S4. Violin plots showing the temporally and spatially averaged statistics of the surface latent heat flux ($\lambda\rho E$), surface sensible heat flux (H), and Bowen ratio (β) from ERA5-Land (green) and GLEAM+ERA5-Land (yellow). Statistics are calculated with respect to in situ eddy-covariance measurements at daily (24 h) temporal resolution. Violin plots represent the distribution of the individual validation statistics with indication of the median and inter-quartile range, and are calculated using a kernel density estimation approach. Statistics include the Bias, Mean Absolute Error (MAE), and the anomaly correlation coefficient (R_{AN}). The scale used to show the bias distribution of β is that of the right y-axis on the top row.



(a) R_{AN} : ERA5-Land vs MODIS LST



(b) R_{AN} : ERA5 vs MODIS LST



(c) R_{AN} : ERA-Interim vs MODIS LST

Figure S5. Global anomaly correlation coefficient (R_{AN}) maps of ERA5-Land (a), ERA5 (b) and ERA-Interim (c) versus MODIS LST average ensemble for the time period 2003–2018.

References

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